PROGRAM: Coordinated Hinode/EIS and ground based observations of the total solar eclipse of 20 Mar 2015

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DURATION: Approximately 5 hours

WHEN: Around 2015 March 20, 10:00 UT

PARTICIPATING INSTRUMENTS: Hinode (EIS, XRT), CoMP, AIA

The total eclipse taking place on 2015 March 20 (at around 10:00 UT) will be observed from the ground at the Faroe Islands (~09:45 UT) and at the Svalbard Islands (~10:12 UT) with a suite of filters designed to isolate and measure the intensity of visible lines from selected key ions like Fe X, XI, XIII and XIV between 5000 A to 11000 A. As the field of view of the observation extends from the limb up to 4 solar radii, these measurements will provide a unique window on the physical properties of the extended solar corona, providing us with AIA-like 2D images of the solar corona, which hold the additional advantages over AIA of 1) better spectral/temperature purity and 2) 10 times larger effective field of view.

Emission lines in the visible are formed by radiative scattering of disk emission starting from approximately 1.1 Rsun. The combination of visible spectral lines with 1) collisionally dominated EUV coronal lines from EIS and 2) visible observations of the background continuum will allow us to apply unique spectroscopic diagnostic techniques that will provide:

1 - The first ever empirical determination of fast and slow solar wind freeze-in heights for Fe;

2 - The empirical determination of the frozen-in Fe charge state composition to be directly compared with in-situ data;

3 - An empirical model of the fast and slow wind velocity, electron temperature and electron density profiles from the limb to the freeze-in region using the novel technique developed by Landi et al. 2012 (ApJ, 750, 159)

4 - Large scale distributions of plasma parameters (electron density, temperature and filling factor) in streamers and coronal holes.

COMP observations of the Fe XIII 10747 and 10800 line pair will allow the determination of the electron density below 1.5 solar

radii to be compared with Hinode/EIS determinations, as well as cross-calibration between EIS, COMP and the eclipse observations.

We propose supporting observations from Hinode/EIS and Hinode/XRT during the eclipse, and for a few hours before and after the eclipse on 2013 November 3. The targets will be slowly evolving large-scale coronal structures (active region, streamer and coronal holes) before, during and after the eclipse. During the eclipse we would like to observe a prominence cavity at the limb, which will allow us to easily co-align EIS observations with eclipse images. In the absence of a cavity, we will observe an active region at the limb.

Details of the requested observations are as follows.

POINTING

We would like to have EIS and XRT observing at the solar limb. The pointing can be easily achieved having SOT pointing on the disk within 15-20 arcsec from the limb, and using the EIS fine mirror mechanism to point at the targets.

TARGETS

During the eclipse: Cavity (if available – PRIMARY target) Limb active region (if cavity unavailable – BACKUP target)

Before and after the eclipse: polar coronal hole/streamer boundary (if available) streamer (if polar holes are not available)

EIS REQUEST (raster size with JPEG90 compression)

If a cavity is available (PCH=Polar Coronal Hole):

Program	Target	Timing	Size(Mb)	Duration
dhb_polar_scan	Streamer/PCH	Before eclipse	383.0	3h 46m
gdz_plume1_2_300_50s	cavity	During eclipse	165.0	1h 8m

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Total                                                548.0    5h
54m
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If no cavity is available:

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Program                 Target          Timing          Size(Mb)
Duration
-----------------------------------------------------------------
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dhb_polar_scan          Streamer/AR     Bef/dur eclipse 383.0    3h
46m
landi_scan_ch           coronal hole    After ecipse    190.0    2h
7m
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Total                                                573.0    5h
53m
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Simultaneous observations with XRT

XRT REQUEST

Time series of images at the solar limb

TARGET: same as EIS

FIELD OF VIEW: 512x512 (384x384 acceptable)

EXPOSURE TIME: Long exposure time (AEC setting = 2)

FILTERS: Al/poly, Ti/poly and Thin-Be

CADENCE: It can be slow, we are not looking for sudden events

Simultaneous observations with EIS

SOT REQUEST

None